NASA TECH BRIEF

Computer Programs for Axial Flow Compressor Design

The problem:

To examine a wide range of design parameters to determine their effects and to indicate significant areas for study and research of multistage axial flow compressors.

The solution:

Four computer programs for the design of axial flow compressors.

How it's done:

1. The first of these programs was based on the assumption of simple radial equilibrium of static pressure and constant efficiency radially. In this program, limits on hub and tip ramp angles, axial velocity ratio across blade rows, rotor hub and stator tip loadings, rotor exit relative flow angle, and stator hub Mach number are specified; the velocity diagram and stage-by-stage performance are calculated.

2. The second program accounts for complete radial equilibrium of flow. Losses are evaluated on the basis of blade element loss prediction methods. Radial distribution of energy is specified as a polynomial variation of whirl velocities at the exit of each blade row; rotor tip loadings are specified as are limiting values of rotor hub relative exit angles, stator hub Mach numbers, stator hub loadings, and the compresor flow path.

3. Program 3 differs from Program 2 in that the radial distribution of total pressure is specified for each rotor blade row rather than the whirl velocity distribution, and there is the option of specifying the flow path or specifying the axial velocity ratios and calculating the resulting flow path.

4. The fourth program developed is an off-design performance calculation. The calculation accounts for variable specific heat and full radial equilibrium and determines energy addition and adiabatic efficiencies on the basis of data for blade element turning and loss.

The program user has available as options either double-circular-arc or NACA 65-series blade performance data, plus the capability of specifying reference incidence angle through tabular input for any individual blade row or through the criterion of suction surface tangency for any double-circular-arc blade row. The off reference increment in deviation angle is furnished in the form of a correlation of selected NASA data.

Notes:

1. This program is written in FORTRAN IV for use on the IBM 7094.

2. Inquiries should be made to:
   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B69-10174

Patent status:

No patent action is contemplated by NASA.

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